

Claims

1. A method of screening a culture of a *Paenibacillus* isolate for a gene that encodes a protein selected from the group consisting of a *Cry* protein that is toxic to a lepidopteran pest and a toxin complex protein, wherein said method comprises at least one of the following steps:
  - (a) obtaining DNA from said culture and assaying said DNA for the presence of said gene; and
  - (b) obtaining protein produced by said culture and assaying said protein for the presence of a protein that indicates the presence of said gene in said isolate.
2. A method of screening a culture of a *Paenibacillus* isolate for a protein that has toxin activity against a lepidopteran pest wherein said method comprises at least one of the following steps:
  - (a) obtaining culture broth produced by said culture and assaying said broth for toxin activity against a lepidopteran pest; and
  - (b) feeding a plurality of said isolates to a lepidopteran pest and observing said pest for effects of a toxin.
3. The method of claim 1 wherein said method comprises screening a collection of *Paenibacillus* isolates for said protein, and said isolate is in said collection.
4. The method of claim 1 wherein said protein is a toxin complex protein.
5. The method of claim 4 wherein said protein enhances the activity of a toxin complex protein.
6. The method of claim 1 wherein said protein is a *Cry* protein that is toxic to a lepidopteran pest.

7. The method of claim 1 wherein said step of obtaining DNA from said culture comprises creating a library of clones from said DNA and assaying at least one of said clones for the presence of said gene.
8. The method of claim 7 wherein said step of assaying said clone for the presence of said polynucleotide comprises assaying said clone for lepidopteran toxin activity, thereby indicating the presence of said polynucleotide.
9. The method of claim 1 wherein said step of assaying said DNA comprises performing polymerase chain reaction with at least one primer that is designed to indicate the presence of said gene.
10. The method of claim 1 wherein said step of assaying said protein comprises immunoreacting an antibody with said protein wherein said antibody is designed to indicate the presence of said protein.
11. The method of claim 1 wherein said step of assaying said DNA comprises hybridizing a nucleic acid probe to said DNA wherein said probe is designed to indicate the presence of said gene.
12. An isolated protein that has toxin activity against an insect pest wherein said protein is encoded by a polynucleotide sequence that hybridizes with the complement of a sequence selected from the group consisting of SEQ ID NOS:2, 4, 6, 8, 10, 12, 14, 32, 34, 35, 38, and 40.
13. The protein of claim 12 wherein said protein is a *Cry* protein and said probe is the complement of SEQ ID NO:14.
14. The protein of claim 12 wherein said protein is a toxin complex protein and said probe is the complement of a sequence selected from the group consisting of SEQ ID NOS:2, 4, 6, 8, 10, 12, 32, 34, 35, 38, and 40.

15. An immunoreactive fragment of a protein according to claim 12.
16. An isolated polynucleotide that encodes a protein according to claim 12.
17. A cell comprising a polynucleotide according to claim 16.
18. The cell according to claim 17 wherein said cell is selected from the group consisting of a plant cell and a microbial cell.
19. A method of controlling an insect pest wherein said method comprises the step of contacting said pest with a protein comprising an amino acid sequence selected from the group consisting of SEQ ID NOS: 3, 5, 7, 9, 11, 13, 15, 18, 19, 33, 36, 37, 39, and 41.
20. The method of claim 1 wherein said *Paenibacillus* isolate is of a species selected from the group consisting of *P. apiarius*, *P. chondroitinus*, *P. alginolyticus*, *P. larvae*, *P. validus*, *P. gordonae*, *P. alvei*, *P. lentimorbus*, *P. popilliae*, *P. thiaminolyticus*, *P. curdlanolyticus*, *P. kobensis*, *P. glucanolyticus*, *P. lautus*, *P. chibensis*, *P. macquariensis*, *P. azotofixans*, *P. peoriae*, *P. polymyxa*, *P. illinoisensis*, *P. amylolyticus*, *P. pabuli*, and *P. macerans*.
21. The method of claim 11 wherein said probe is derived from a gene selected from the group consisting of *tcaA*, *tcaB*, *tcaC*, *tcbA*, *tccA*, *tccB*, *tccC*, *tcdA*, *tcdB*, *xptA1*, *xptD1*, *xptB1*, *xptC1*, *xptA2*, *sepA*, *sepB*, and *sepC*.
22. The method of claim 9 wherein said primer is derived from a gene selected from the group consisting of *tcaA*, *tcaB*, *tcaC*, *tcbA*, *tccA*, *tccB*, *tccC*, *tcdA*, *tcdB*, *xptA1*, *xptD1*, *xptB1*, *xptC1*, *xptA2*, *sepA*, *sepB*, and *sepC*.
23. The method of claim 9 wherein said primer is selected from the group consisting of SEQ ID NOS: 22, 23, 24, 25, 26, 27, 28, 29, 30, and 31.

24. A biologically pure culture of a *Paenibacillus* strain selected from the group consisting of DAS1529 (available under NRRL B-30599) and DB482 (available under NRRL B-30670).